

## Chapter 4

# Alternatives Evaluation

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This chapter compares and evaluates the trade-offs of the Sound Transit Link Light Rail Operations and Maintenance Satellite Facility (OMSF) build alternatives and their effectiveness in addressing the proposed project's goals and objectives stated below. It takes into account differences in the alternative locations and facility designs described in Chapter 2, *Alternatives Considered*, and potential effects on the environment, including the ability to avoid or mitigate environmental impacts described in Chapter 3, *Affected Environment and Environmental Consequences*.

### 4.1 Effectiveness at Meeting the Goals and Objectives

As described in Chapter 1, *Purpose and Need for the Project*, the purpose and need for the proposed project is to enable Sound Transit to meet the maintenance and storage needs of the expanded fleet identified in ST2, with sufficient capacity to allow expansion of the light rail system beyond ST2 in the corridor where it is located. The existing Forest Street OMF in Seattle does not have the capacity to store, maintain, and deploy the entire ST2 fleet. All of the OMSF build alternatives would meet the project purpose and need, but would differ in impacts. The No Build Alternative would not meet the purpose and need for the proposed project.

Based on the Purpose and Need, Sound Transit developed goals and objectives to compare the build alternatives and evaluate the trade-offs. These goals and objectives address Sound Transit's responsibility to meet public transportation and mobility needs for high-capacity transit infrastructure while also being a responsible steward of the environment and planning a fiscally feasible project. These goals and objectives include the following:

- **Transportation Goal.** Facilitate operation of the expanded regional Link light rail system.
  - Locate a facility to provide efficient and reliable light rail service.
- **Environment Goal.** Preserve environmental quality.
  - Minimize potential adverse impacts on the natural and built environment.
- **Financial Goal.** Achieve financial feasibility.
  - Build, operate, and maintain a cost-effective facility.

The BNSF Alternative has been identified as the Preferred Alternative based on the degree and magnitude of impacts; the ability to mitigate those impacts; and its effectiveness in addressing the proposed project's goals and objectives, as described in the following sections of this chapter.

### **4.1.1 Transportation Goal: Facilitate Operation of the Expanded Regional Link Light Rail System**

#### **4.1.1.1 No Build Alternative**

Under the No Build Alternative, an OMSF would not be built, and light rail service would rely on the Forest Street Operations and Maintenance Facility (Forest Street OMF), which lacks the capacity to maintain and operate a light rail fleet at planned service levels under *Sound Transit 2: A Mass Transit Guide, The Regional Transit System Plan for Central Puget Sound (ST2)*. The Forest Street OMF would have to serve the entire Link light rail system including Central Link and ST2 extensions to Bellevue and Redmond, Lynnwood, and Kent/Des Moines. The East Link storage track would provide overnight storage and morning deployment of up to 16 light rail vehicles (LRVs), but would not provide maintenance functions.

The No Build Alternative does not meet the goal of facilitating operation of the expanded light rail system and locating a facility to provide efficient and reliable light rail service. With a fleet constrained to 104 LRVs operating principally from the Forest Street OMF, Link service would include fewer train cars and longer headways between trains (11 minutes during peak periods), which would reduce the system's passenger capacity by more than 40% compared to the build alternatives. This would not meet projected demand and would likely result in passenger overcrowding on trains and station platforms. To establish morning service on the Eastside, Sound Transit would have to deploy some trains from the Forest Street OMF, which would have to turn back at the International District and/or Northgate Stations to reach the east operating line, creating more operational disruptions and inefficiency.

The No Build Alternative could not maintain the 4-hour nightly inspection and maintenance window (approximately 1:00 a.m. to 5:00 a.m.), because trains would have to be deployed earlier to serve the 6:00 a.m. to 10:00 a.m. morning peak period. If all vehicles were stored at the Forest Street OMF, a system failure during the morning deployment could trap the entire fleet and prevent service.

#### **4.1.1.2 Build Alternatives**

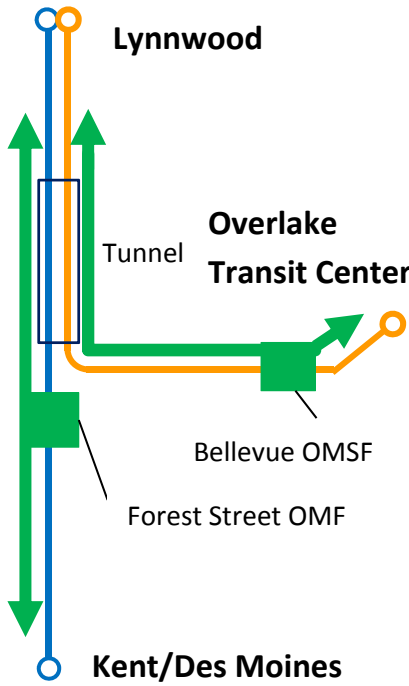
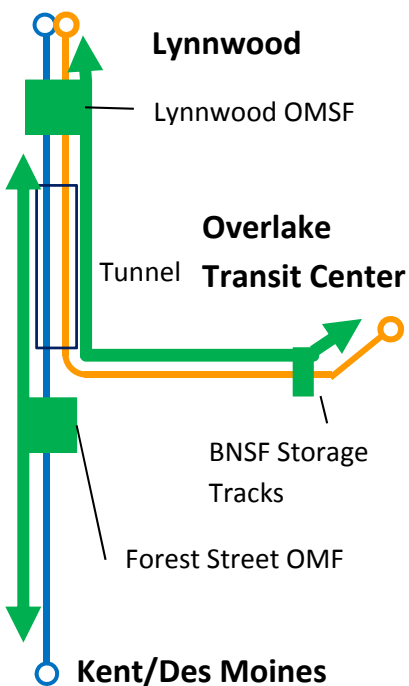
Assuming that the Forest Street OMF would continue to provide inspection, heavy repair, and overhaul services, each of the build alternatives would enable Sound Transit to meet ST2 planned service levels. The OMSF would be located on either the north operating line or the east operating line to provide efficient and reliable light rail service. Below is a description of the advantages and disadvantages of each build alternative in supporting the operation of the expanded Link system. The discussion focuses on distinctions related to site operations and deployment of LRVs.

Table 4-1 shows how the ST2 fleet of LRVs (approximately 180 LRVs total) would be stored at each facility. The Forest Street OMF would store enough LRVs to provide service for the Lynnwood–Kent/Des Moines line plus spare LRVs: 20 four-car trains and 12 spare LRVs, for a total of 92 LRVs.

Eighty-eight LRVs for the Lynnwood–Overlake Transit Center line would be stored at an OMSF in Bellevue or at the Lynnwood OMSF and BNSF Storage Tracks.

Each morning, trains leaving the Forest Street OMF would be deployed to Lynnwood and to Kent/Des Moines. One or more trains would also be deployed northbound to the International District/Chinatown Station and begin southbound service from there. This would allow passengers arriving by bus or train from the north and east in the early morning to transfer for points south, including SeaTac/Airport Station.

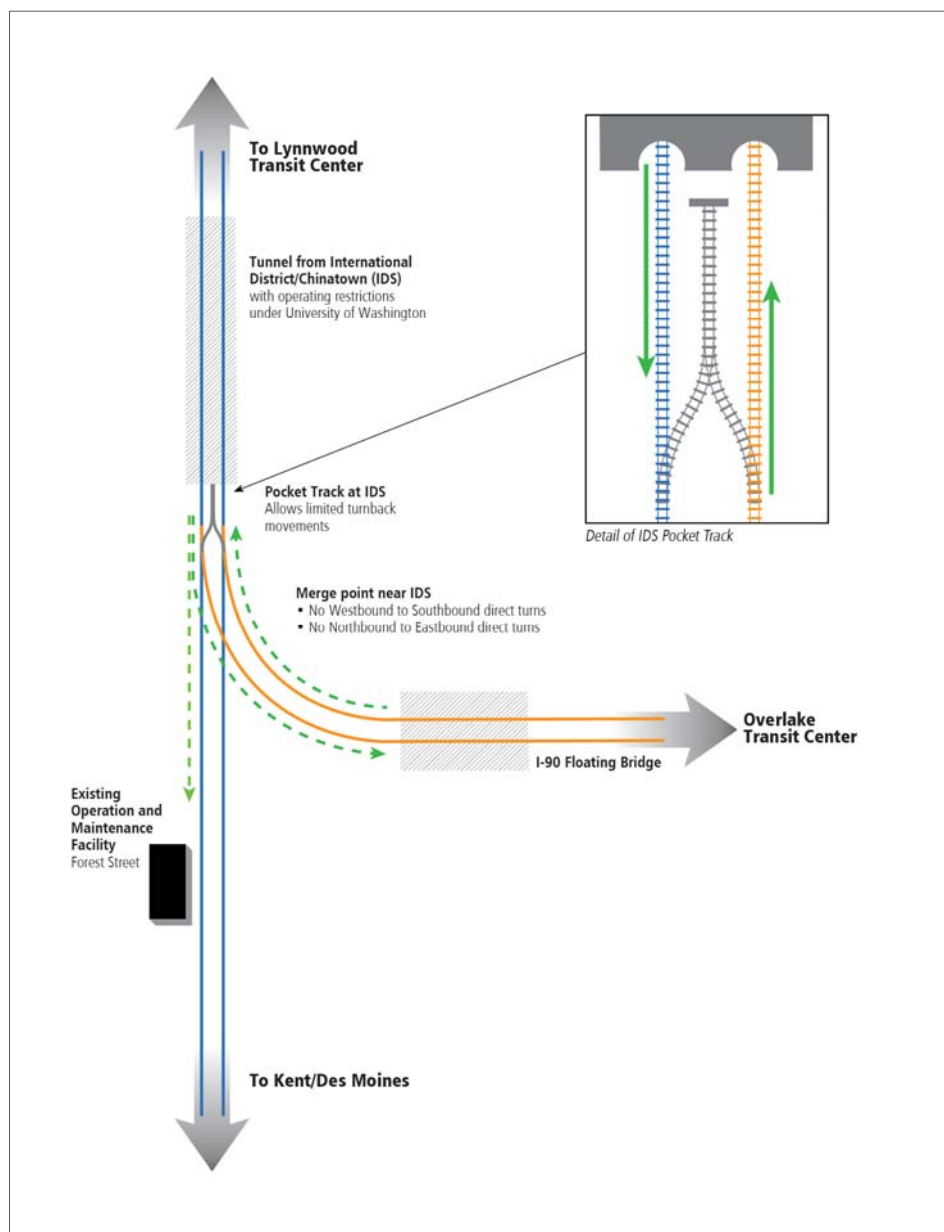
**Table 4-1. Fleet Storage and Deployment by Build Alternative**

	Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative			Lynnwood Alternative, BNSF Storage Tracks		
						
	Forest Street OMF	Lynnwood OMSF	Bellevue OMSF	Forest Street OMF	Lynnwood OMSF	BNSF Storage Tracks
Peak service trains stored (4-car trains)	20	-	19	20	11	8
Spare LRVs stored	12	-	12	12	12	0
Total LRVs stored	92	-	88	92	56	32
Off-Peak headway after 6:30 p.m. for the Lynnwood – Overlake Transit Center Line	10 minutes			15 minutes		

At Overlake Transit Center, morning service would start at approximately the same time regardless of alternative. For the Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative, trains would deploy from the OMSF in Bellevue; whereas, under the Lynnwood Alternative, trains beginning service at Overlake Transit Center would be deployed from the BNSF Storage Tracks.

Figure 4-1 illustrates some key operational constraints of the light rail system. For example, at the merge point of the two operating lines south of the International District/Chinatown Station, the configuration of the tracks does not allow direct northbound to eastbound, or direct westbound to southbound turns. This and other characteristics of the light rail system are described below in the context of comparing the build alternatives.

**Figure 4-1. Light Rail Operating Constraints**



### **Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative**

The Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative would operate similarly because in all cases the OMSF would be located in the Bel-Red area of Bellevue along the East Link extension. The OMSF in Bellevue would store enough LRVs to provide service for the Lynnwood–Overlake Transit Center line plus spares. It would store 19 four-car trains (76 LRVs) and 12 spare LRVs, for a total of 88 LRVs. During the morning start-up service, trains at the OMSF in Bellevue would be deployed first going west toward Seattle/Rainier, Mercer Island, and downtown Bellevue. Then trains would be deployed directly east to Overlake Transit Center before turning back to head west. After the initial morning start-up, trains at the OMSF in Bellevue would be deployed west to serve Bellevue and Seattle, and north to serve Lynnwood.

#### ***Advantages***

- **Ability to Maintain Off-Peak Headways.** Off-peak 10-minute headways could be maintained on both operating lines until 10:00 p.m. as planned.
- **Limited Service Disruptions.** If the Interstate 90 (I-90) floating bridge is closed, service could be maintained between Mercer Island and the Overlake Transit Center (Figure 4-1). If there is a disruption on the line between Lynnwood and Kent/Des Moines, limiting access to the Downtown Seattle Transit Tunnel, service could be maintained between the Rainier Station and the Overlake Transit Center.

#### ***Disadvantages***

- **East Link Operating Speed.** The SR 520 Alternative lead track connection to the East Link mainline would reduce the operating speed through this short portion of the mainline. Modifications to the profile and geometry of this portion of the East Link mainline would be required to accommodate the lead track connection, and would require lower speeds on the mainline.

### **Lynnwood Alternative**

The Lynnwood Alternative would store enough LRVs for the peak service requirement for the Lynnwood–Overlake Transit Center line plus spares. The Lynnwood OMSF would store 11 four-car trains (44 LRVs) and 12 spare LRVs, for a total of 56 LRVs. The BNSF Storage Tracks would store eight four-car trains for a total of 32 LRVs.

Service trains at the Lynnwood OMSF would be deployed toward the north to reach the Lynnwood Transit Center, and would then turn back to begin service toward the south. Some trains would deploy south directly from the Lynnwood OMSF during the start of service. Service trains at the BNSF Storage Tracks would be deployed first toward the west toward downtown Bellevue, Seattle, and Lynnwood; some trains would be deployed directly east to Overlake Transit Center before turning back to head west.

### **Advantages**

- **Earlier Lynnwood Service.** Because LRVs would be stored very close to the terminus of the system in Lynnwood and deployed first toward the station at the Lynnwood Transit Center, this alternative would allow service to begin in Lynnwood for the Lynnwood–Overlake Transit Center line about 30 minutes earlier than the Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative.

### **Disadvantages**

- **Reduced Evening Headways and Level of Service.** The time needed to complete daily cleaning and inspection functions at the BNSF Storage Tracks would require some vehicles be removed from service on the Lynnwood–Overlake Transit Center line earlier in the evening. This would result in longer headways after 6:30 p.m. (15-minute instead of 10-minute headways), which would not meet Sound Transit’s planned off-peak headway as shown in Section 3.1, *Transportation* (Table 3.1-1). Because the two operating lines merge together at International District/Chinatown Station (Figure 4-1), the uneven headways would create irregular spacing between trains along the shared tracks after 6:30 p.m. This could result in degraded levels of service or passenger frustration, such as trains from the two lines arriving at the merge point at the same time, or longer than planned wait times at specific stations.
- **Vehicle Rotation Inefficiency.** Because the BNSF Storage Tracks would only accommodate daily vehicle inspections and cleaning, LRVs would need to rotate to the Forest Street OMF or Lynnwood OMSF for other scheduled or unscheduled maintenance, inspection and washing. This would introduce inefficiency and additional train movements in daily system-wide operations.
- **Tunnel Restrictions.** The tunnel between downtown and Northgate has special operating restrictions near scientific research buildings on the University of Washington (UW) campus related to electromagnetic interference and vibration (Figure 4-1). Disabled trains south or east of Husky Stadium would be taken to the Forest Street OMF, which could become unbalanced with unscheduled maintenance activities.
- **Increase in Trains Traveling to and from the Eastside.** If a train traveling on the Eastside were to experience mechanical, cleanliness, or other issues once on line, it would be pulled off line and stored on the Eastside until it could be brought to either the Forest Street OMF in Seattle or the Lynnwood OMSF and replaced with an in-service vehicle. This would generally be handled during the post-peak period. This could add to the number of trips traveled to and from the Eastside depending on the issues that day.

## **4.1.2 Environmental Goal: Preserve Environmental Quality**

### **4.1.2.1 No Build Alternative**

The No Build Alternative supports the goal of preserving environmental quality by minimizing certain potential adverse impacts on the natural and built environment; however, beneficial impacts

of the proposed project would not be realized. Regional, state, and local land use and transportation plans include goals for improving transit accessibility and encouraging transit use as the region's population grows. At a regional level, achieving these goals would reduce vehicle emissions and improve air quality. Focusing growth and development in urban centers helps preserve vegetation and water quality at the watershed scale, and helps limit the adverse effects of sprawl. Transit accessibility in and between urban centers is one of many critical elements needed to realize these goals. Enabling planned service levels on light rail system extensions under ST2 would increase transit accessibility and reduce congestion. The No Build Alternative would not support planned service levels and would limit the light rail system's ability to help meet adopted planning goals for the region and state.

On a local scale, the No Build Alternative would avoid business displacements; construction-related impacts such as traffic, dust, and noise; and impacts on ecosystems resources. Unlike the build alternatives, it would not clean up contaminated soils at certain properties or upgrade on-site water quality detention and treatment systems to current standards.

#### **4.1.2.2 Build Alternatives**

NEPA and SEPA require this EIS to assess many different measures of the proposed project's social, economic, and environmental impacts. All of the build alternatives would have similar impacts in the areas of transportation; social, community facilities, and neighborhoods; visual and aesthetic resources; air quality and greenhouse gases; energy; hazardous materials; electromagnetic fields; geology and soils; utilities; and historic and archaeological resources. Although noise impacts would vary among alternatives, all of them could be fully mitigated. The types of impacts relative to each resource area that differentiate the alternatives are summarized in Table 4-2.

#### **Preferred Alternative**

When compared to the other build alternatives, the Preferred Alternative would have the fewest acquisitions, displacements, and aquatic impacts, and the second-fewest permanent wetland and vegetation impacts. It would also have the second-greatest amount of surplus property available for redevelopment and would be compatible with the existing surrounding uses because the building mass, size, and use would be typical of the surrounding area. However, it would be inconsistent with the Bel-Red land use plans and zoning designations in this location, which anticipate a transition over time from the current industrial character to a higher-density, mixed-use, transit-oriented development (TOD) pattern of retail, office, and residential uses near the 120th Avenue Station.

The City's land use code would allow an OMSF with a Conditional Use Permit or land use code amendment approval from the City of Bellevue. As described in Chapter 2, Section 2.6.1, *Preferred Alternative*, the Preferred Alternative has been refined since the Draft EIS to reduce the facility footprint and allow more land for TOD. The potential TOD target areas are focused on the south and east sides of the facility, closest to the 120th Avenue Station.

**Table 4-2. Differentiating Characteristics and Impacts of the Build Alternatives**

Differentiating Characteristic	Preferred Alternative	BNSF Modified Alternative	SR 520 Alternative	Lynnwood Alternative
<b>Acquisitions, Displacements, and Relocations</b>				
Number of parcels acquired	7	14	13	14
Number of existing land uses displaced	14	25	101	14
<b>Land Use</b>				
Consistent with zoning / comprehensive plan designations	No; would require a conditional use permit or land use code amendment from the City of Bellevue	No; would require a conditional use permit or land use code amendment from the City of Bellevue	No; would require a conditional use permit or land use code amendment from the City of Bellevue	No; would require a conditional use permit or land use code amendment from the Cities of Bellevue and Lynnwood and a comprehensive plan amendment from the City of Lynnwood
Surplus land available for redevelopment	6 acres	8 acres	0 acres	13 acres
<b>Economics</b>				
Loss of annual property tax revenue (2014)	\$271,300	\$319,300	\$584,900	\$403,600
<b>Noise and Vibration</b>				
Affected Properties	1 property zoned mixed use, currently Metro base (None after mitigation)	None	None	19 residential properties (None after mitigation)



Differentiating Characteristic	Preferred Alternative	BNSF Modified Alternative	SR 520 Alternative	Lynnwood Alternative
<b>Ecosystems and Water Resources</b>				
Aquatic impacts	0.0 acres	0.0 acres	Approximately 700 feet of stream (Goff Creek) and 0.64 acre of functional stream buffer	Approx. 150 feet of stream (Scriber Creek), 1.9 acre of functional stream buffer, 380 feet of floodplain (elevated guideways), and ~1,000 cubic yards of floodplain and fill (OMSF)
Vegetation and wildlife impacts (vegetation removal)	4 acres	6 acres	2 acres	12 acres (OMSF and elevated guideways) and <1 acre (BNSF Storage Tracks)
Jurisdictional Ditch impacts (direct)	0.0 linear feet 0.0 acres	415 linear feet 0.03 acre	250 linear feet 0.02 acre	65 linear feet 0.01 acre (BNSF Storage Tracks)
Wetland impacts (permanent)	0.5 acre	1.1 acres	0.4 acre	2.5 acres (OMSF and elevated guideways) and 0.1 acre (BNSF Storage Tracks)
Groundwater and stream baseflow impacts	No	No	Yes	No
<b>Public Services</b>				
Number of direct impacts on essential public facilities	0	1	0	1
<b>Parkland and Open Space</b>				
Number of temporary impacts on park resources	0	0	0	1

Based on the City of Bellevue's noise ordinance, there is a potential noise impact on a neighboring commercially zoned property (the King County Metro East Base) that would be mitigated. Additional coordination with Seattle Children's Hospital: Bellevue Clinic and Surgery Center would need to occur to ensure any vibration sensitive equipment or activities are not impacted during construction.

### **BNSF Modified Alternative**

The BNSF Modified Alternative would have the second greatest displacements, vegetation impacts, wetland impacts, and surplus land available for redevelopment. It would result in more property acquisitions than the Preferred Alternative and SR 520 Alternative and would displace the Bellevue Public Safety Training Center. Similar to the Preferred Alternative, the BNSF Modified Alternative would be inconsistent with local zoning and would require a conditional use permit (CUP) or land use amendment approval from the City of Bellevue. Compared with the Preferred Alternative, the BNSF Modified Alternative would be farther away from the 120th Avenue Station. It would also be set farther back from 120th Avenue NE, allowing for future mixed-use development along 120th Avenue NE, consistent with land use plans nearest to the light rail station.

### **SR 520 Alternative**

The SR 520 Alternative would have the least amount of vegetation impacts, wetland impacts, and acquisitions. However, it would have the greatest amount of aquatic impacts from piping a portion of Goff Creek that is currently open channel. It would result in substantially more business and employee displacements (approximately 101 businesses and over 1,000 employees) than any other build alternative. This impact is reflected in the greatest loss in property tax revenue. Due to the configuration and constraints of the site, there would be no surplus property available for redevelopment under this build alternative. It is inconsistent with local zoning and would require a similar CUP approval or land use code amendment as the Preferred Alternative or BNSF Modified Alternative. However, its site is located farthest away from the future East Link stations, outside of Bel-Red land use designations for mixed-use TOD.

### **Lynnwood Alternative**

The Lynnwood Alternative would have the greatest vegetation removal and permanent wetland impacts and the second greatest aquatic impacts, affecting Scriber Creek. It would have the same amount of acquisitions as the BNSF Modified Alternative, but would have the most surplus land available for redevelopment. One of the parcels that would be acquired is planned to be developed as a district support center by the Edmonds School District. Although the site is currently zoned for Light Industrial and Business/Technical Park uses, the OMSF is not explicitly addressed in the City's land use code and would require a Conditional Use Permit approval from the City of Lynnwood, or an amendment to the City's comprehensive plan and zoning code. This is the only build alternative that has the potential to affect existing residential uses (the Cedar Valley neighborhood west of the Lynnwood Alternative site) due to the increase in noise. However, the 19 predicted noise impacts would be mitigated, with OMSF noise levels below the FTA noise impact criteria and Lynnwood

noise ordinance at all affected properties. The Lynnwood Alternative is the only build alternative that would result in a temporary impact on a recreational resource. Construction of the elevated lead track would require temporary closure and detour of the Interurban Trail.

### 4.1.3 Financial Goal: Achieve Financial Feasibility

#### 4.1.3.1 No Build Alternative

Under the No Build Alternative, there would be no capital cost or operating cost because the proposed project would not be implemented. The absence of expanded operations and maintenance capacity would likely diminish the competitiveness of the ST2 Link light rail extensions for federal grant funding and light rail service efficiency would be reduced.

#### 4.1.3.2 Build Alternatives

All build alternatives are financially feasible and could be developed and supported by ST2 tax revenue. Capital costs of the proposed project (including property acquisition, relocation, construction, and design/permitting/administrative costs) are estimated to range from \$380 million (Preferred Alternative) to \$440 million (BNSF Modified Alternative), as described in Chapter 2, Section 2.9, *Funding and Estimated Project Costs*, and Table 4-3. The Preferred Alternative would have the second lowest property and relocation costs and the lowest design and construction costs. This is due to the relatively flat site topography and limited number of properties and businesses that would be acquired and displaced. The BNSF Modified Alternative would have the highest capital costs, due to higher property and relocation costs and the structural complexity of this alternative (e.g., need for earthwork and retaining walls and elevated track work spanning the Eastside Rail Corridor). The SR 520 Alternative would have the second highest property and relocation costs due to the large number of businesses that would be displaced, but the second lowest costs for design and construction. The Lynnwood Alternative would have the lowest property and relocation costs, but the second highest construction costs. This is due to costs to design and construct two separate facilities and the length of elevated lead track.

**Table 4-3. Estimated Capital and Operating Costs of the Build Alternatives**

Build Alternative	Real Estate and Relocation (million dollars) <sup>a</sup>	Final Design and Construction (million dollars) <sup>a,b</sup>	Total Capital Cost (million dollars) <sup>a</sup>	Annual Operating Cost (million dollars) <sup>c</sup>
Preferred Alternative	\$100	\$280	\$380	\$70
BNSF Modified Alternative	\$110	\$330	\$440	\$70
SR 520 Alternative	\$105	\$310	\$415	\$70
Lynnwood Alternative	\$55	\$330	\$385	\$73

<sup>a</sup> 2015 dollars.

<sup>b</sup> Includes professional services and unallocated contingency.

<sup>c</sup> Annual labor cost in 2015 dollars to operate the facility.

Annual OMSF operating costs (i.e., facility maintenance and labor costs) are estimated to range between \$70 million (Preferred Alternative, BNSF Modified Alternative, and SR 520 Alternative) and \$73 million (Lynnwood Alternative). The increased annual operating costs for the Lynnwood Alternative relate directly to the need for a separate storage track facility in Bellevue. The added annual operating costs are primarily labor costs driven by the additional staff needed to operate and maintain the two separate facilities under the Lynnwood Alternative.

## **4.2 Commitment of Resources**

If built, the proposed project would have irreversible and irretrievable commitments of property and natural resources. Private properties with industrial and commercial uses would be converted to transit use. The conversion of lands to light rail use would change the character of the Lynnwood Alternative site. The proposed project would affect wetlands, wildlife habitat, and aquatic resources to varying degrees, and in Bellevue, would affect the realization of the vision for the Bel-Red neighborhood, depending on the alternative selected and built. Despite mitigation measures, some of these resources would still be irretrievably altered. Construction of the proposed project would also require the irretrievable commitment of a small amount of resources such as fuel and construction materials (e.g., aggregate for concrete, wood for forms and frames, and steel for rebar and rails).

## **4.3 Areas of Controversy and Issues to Be Resolved**

The following are known areas of controversy and issues to be resolved:

- If selected, the Preferred Alternative's design would minimize conflicts related to locating the proposed project in an area envisioned for TOD within the Bel-Red Corridor, and Sound Transit would continue coordinating with the City of Bellevue and OMSF stakeholders as the facility design progresses. Such coordination would be focused on encouraging TOD on surplus land adjacent to the OMSF closest to the 120th Avenue Station, and on design treatments of the OMSF to maximize compatibility of the facility in the Bel-Red Corridor. Additional coordination with King County would be required related to planning and development of a trail within the Eastside Rail Corridor as well as trail connections between the Eastside Rail Corridor and the 120th Avenue Station area near to the OMSF, should the Preferred Alternative be selected.
- The BNSF Modified Alternative would displace the Bellevue Public Safety Training Center, a regional facility used for training by a number of law enforcement and firefighting agencies. The facility's unique uses and location would be challenging to relocate elsewhere in Bellevue.
- The large number of business displacements that would occur with the SR 520 Alternative is controversial.
- The Edmonds School District is advancing development of the school bus maintenance element of the District Support Services Center. If the Lynnwood Alternative were selected, Sound Transit would need to work with the district to determine whether the district could and would

develop the portion of the Lynnwood Alternative site not needed for the OMSF to accommodate the bus maintenance element and/or other functions of the planned district support center. This would likely require modifications to the design of both the Lynnwood Alternative and the Edmonds School District Support Services Center.